UC Irvine
School of Physical Sciences

2025 Dean's Report

Bold **Science**. Lasting **Impact**.

Degrees Awarded in 2025

505

Undergraduate Degrees

110

Graduate Degrees

Dean's Message

At the UC Irvine School of Physical Sciences, our mission is clear: to shape a better future for the world. This year's report reflects how we live that mission—by expanding the boundaries of knowledge and preparing the next generation of scientists and mathematicians to lead in industry, academia and beyond.

What is so special about our school? Nothing matches solving nature's puzzles about the physical world. From Einstein to Curie, from Gauss to Sagan, generations of scientists have been driven by that magic moment of discovery or understanding. After years or even decades of effort, discovery often arrives in a single moment of sheer joy: you suddenly see what you couldn't see before, what no-one had ever seen before. Those moments of joy happen just about every day in the School of Physical Sciences, where our aim is to make the most meaningful discoveries we can, inspire young scientists to share in this journey, and share our joy with the world.

Our faculty and students drive discoveries that address humanity's toughest challenges, from pioneering quantum technologies, advancing climate solutions or transforming health through next-generation medicines.

These breakthroughs don't stay in the lab; they translate into real-world impact, creating jobs, fueling industries and improving lives.

We are at an inflection point. Orange County is emerging as a hard-tech hub; UC Irvine's national visibility is rising rapidly; and the physical sciences are at the heart of many of the technological and societal challenges of the next decade. This is why we are deeply committed to building a diverse and skilled STEM workforce. Through programs like CalTeach and MathCEO, we're training future educators and scientists to lead in science, technology and education. Nearly one-third of our undergraduates are first-generation college students—as I was—and more than a quarter come from low-income backgrounds. Their success is our success, and their future contributions will strengthen Orange County and the world.

As you read this report, I hope you will see our values in action: excellence, access and impact. Together with our partners, alumni and friends, we are building a stronger Irvine, a stronger Southern California and a better world.

Thank you for taking part in our journey.

Kieron Burke

Kieron Burke, Ph.D.
Interim Dean, School of Physical Sciences
Distinguished Professor of Chemistry and Physics & Astronomy
University of California, Irvine

UC Irvine
School of Physical Sciences

Physical Sciences Leadership

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Distinguished Professor of Chemistry and Physics & Astronomy

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Associate Dean, Academic Affairs
Mu-Chun Chen
Professor of Physics & Astronomy

Associate Dean, Graduate Studies
Franklin Dollar
Professor of Physics & Astronomy

Associate Dean, Research
John Lowengrub
Distinguished Professor of Mathematics

Associate Dean, Undergraduate Education
David Van Vranken
Professor of Chemistry

2025 Dean's Report

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Highlights

The Eddleman Quantum Institute — $64.7M to Shape the Future of Quantum Discovery

"Quantum science holds significant promise for humanity," said philanthropist Roy T. Eddleman in 2021. To catalyze that promise, his estate gifted $64.7 million, launching the Eddleman Quantum Institute (EQI) and cementing Southern California as a quantum science hub.

Roy T. Eddleman

EQI links UC Irvine with Caltech and UC Santa Barbara, forging a powerhouse partnership in research, education, and student opportunity. Eddleman's vision: "To realize its fullest potential, we need to provide adequate support to the young scientists who want to pursue careers in this field."

Eddleman's support has already had significant impact:

- 75+ graduate students funded with Eddleman fellowships, including over 25 at UC Irvine
- Funding for faculty, postdocs, and breakthrough experiments across institutions
- Dedicated resources for conferences, collaborations, and fundamental discovery at the atomic level

"Through his generous donations to the University of California, Irvine, Roy Eddleman expressed his confidence in our researchers' ability to positively impact the world with their work. The Eddleman Quantum Institute is an example of what can be achieved through a combination of generosity, ambition and the determination to conquer the unknown."

– **UC Irvine Chancellor** Howard Gillman

UC Irvine Launches Master's Program in **Applied Artificial Intelligence for Science**

The UC Irvine School of Physical Sciences launched a Master of Applied Artificial Intelligence for Science, a professional degree designed to equip scientists with cutting-edge AI tools for real-world impact in multiple fields.

The Master of Applied AI for Science addresses a gap in traditional data science programs, which primarily serve computer science and engineering students aiming for tech careers. Instead, the degree is designed for scientists who want to lead AI adoption in research and industry.

The program will be open to domestic and international students with a bachelor's degree in physical or biological sciences or the equivalent. Applicants do not need a background in programming or prior work experience.

Learn More About The Program

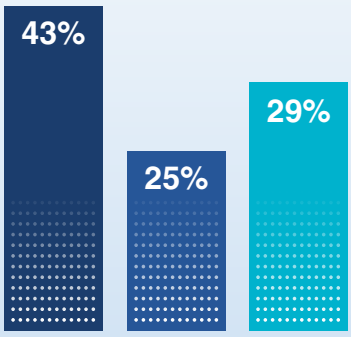
At-A-Glance

- Designed for scientists, the Master of Applied Artificial Intelligence for Science program fills a critical gap in AI education.
- Students will gain hands-on experience with real-world data and industry-relevant AI tools to advance their careers.
- The first cohort will start the nine-month, in-person program during UC Irvine's fall 2026 quarter.

Facts & Figures

2,443

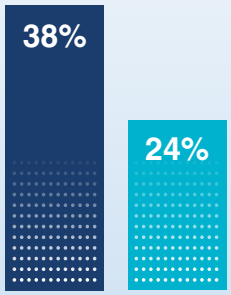
Undergraduate Students
as of Fall 2024



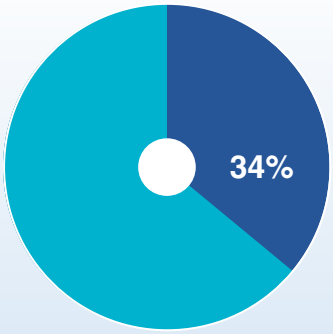
- Women
- Low-income students
- First-generation college students

509

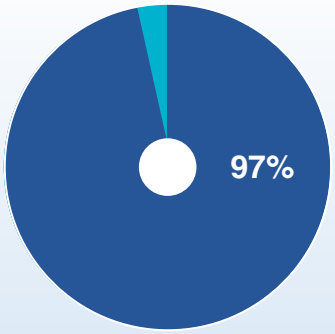
Graduate Students
as of Fall 2024



- Women
- First-generation college students



More than 34% of graduating seniors completed at least one quarter of STEM research



Over 97% of all UC Irvine undergraduate students take Physical Sciences courses

Student Excellence

Undergraduate Mathematics Committee Hosts Second Annual Integration Bee

Undergraduate Mathematics Committee

The UC Irvine Undergraduate Mathematics Committee (UMC) hosted its second annual Integration Bee on Saturday, March 1 in the Interdisciplinary Science and Engineering Building. Modeled after the MIT Integration Bee, the event gives undergraduate students an opportunity to solve integration problems for a cash prize of up to $75.

Sixteen contestants, chosen from a group of over 30 participants based on their performance on qualifying exams, competed in a tournament-style competition. Professors Christopher Davis, Paul Carter and Luke Smith judged the competition as contestants advanced through each round until one was left standing.

Undergraduate Mathematics Committee

This year, Davin Huynh, a fourth-year undergraduate math student, claimed first place, successfully defending his title after also winning UMC's inaugural Integration Bee in 2024. Simin Kim, a second-year undergraduate math student, secured second place, while first-year undergraduate math student Xiangzhao Zhu finished third. ●

Ph.D. student defends Dissertation at South Pole After 24-day Research Expedition

Belgium's Princess Elisabeth Antarctica research station in East Antarctica's Queen Maud Land was the site of the successful Ph.D. dissertation defense by Ratnakar Gadi, UC Irvine Earth system science graduate student. International Polar Foundation

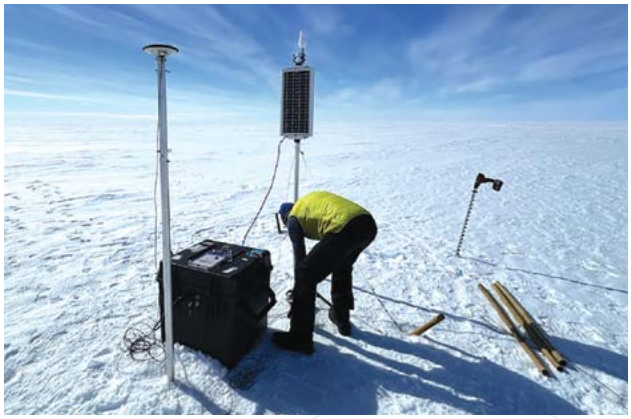
Ratnakar Gadi, a graduate student in UC Irvine's Department of Earth System Science, made history when he successfully defended his Ph.D. dissertation earlier this year. He is the first to have done so at Belgium's Princess Elisabeth Antarctica, the world's only zero-emission polar research facility in East Antarctica.

His dissertation was a comprehensive study of the dynamics at play beneath two of the world's most significant glaciers, Petermann Glacier in Northwest Greenland and Thwaites Glacier in West Antarctica. For the work, Gadi used a combination of modeled ice melt rates, satellite data-derived melt maps and other data sources to examine conditions at ice grounding zones, where glaciers leave the land and begin floating in the ocean.

Gadi's research helped him conclude that seawater intrusion in these areas is a much stronger contributor to ice sheet deterioration and global sea level rise than previously recognized by the polar ice research community. He proposes that climate modelers reconsider the role of ice grounding zone vulnerability to warming ocean water driven by climate change. ●

This was adapted from a story originally published on March 17, 2025 by UC Irvine News.

Immediately before his history-making dissertation defense, Ratnakar Gadi (left) joined his thesis advisor, Eric Rignot, UC Irvine Distinguished Professor of Earth system science, on a 24-day field expedition to study the King Baudouin Ice Shelf. Quinten Vanhellemont, Institute of Natural Sciences, Belgium / International Polar Foundation



While on the research expedition in East Antarctica, mountain guide Daniel Mercier installs a new global navigation system station on the King Baudouin Ice Shelf to support the upcoming NISAR satellite mission.

Physics Students Shine at National Conferences

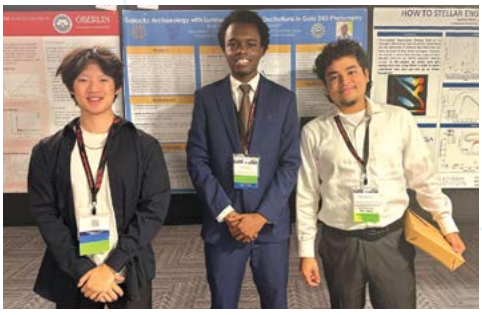
Last November, seven students from UC Irvine's School of Physical Sciences attended the joint conference of the National Society of Black Physicists and National Society of Hispanic Physicists in Houston, Texas. The event offered students opportunities to present research, build networks, and learn from diverse leaders in physics.

Ph.D. student Patricia Fofie, who studies galaxy evolution with Professor Emeritus James Bullock, presented her research on how supermassive black holes influence galactic structure. Her work uses simulations to show how black hole feedback disrupts star formation in disk galaxies. The presentation earned her the prestigious AAS Beth Brown Memorial Award, which includes a year of membership in the American Astronomical Society and invitations to lecture at the University of Michigan and Howard University.

"It felt phenomenal to win the award," said Fofie, who also helps lead Rising Stargirls, an outreach program connecting underrepresented girls to astronomy through the arts.

In January, undergraduate physics major Rasmieh Abdelkarim attended her first conference: the Conference for Undergraduate Women and Gender Minorities in Physics (CU*iP) at UC San Diego. She was inspired by the speakers and gained practical skills in networking, graduate applications, and balancing research with well-being.

"I met so many new people and learned equally as many valuable skills," said Abdelkarim, who plans to pursue a career in astrophysics and astrobiology, with a strong focus on outreach. "It was this type of outreach that brought me into science in the first place." ●



UC Irvine

UC Irvine School of Physical Sciences undergraduates Luke Xia, Bryan Nnadi and Vincent Caudillo pose in front of Nnadi's research poster at the joint NSBP-NSHP conference.

UC Irvine Students Lead Community-Centered Climate Solutions

UC Irvine's CLIMATE Justice Initiative (CJI) is empowering students to tackle environmental challenges through community-driven research. The 2024–2025 cohort of graduate and postbaccalaureate fellows recently presented projects designed in collaboration with local organizations and residents.

UC Irvine

UCI CLIMATE Justice Initiative fellows Bryant Pahl (left) and Miranda Elizarraras Botello presented their teams' community-based research this week at the Interdisciplinary Science and Engineering Building.

One project, led by Ph.D. candidate Bryant Pahl and postbaccalaureate Kevin Olivas Ordoñez, addresses extreme heat in Santa Ana—an increasingly deadly consequence of climate change. Building on work by fellow Haley Staudmeyer, the team is surveying residents to understand how they cope with heatwaves and whether existing cooling centers meet community needs. Promotoras, or local health workers, are helping distribute surveys to ensure the research reflects lived experiences. "The best solution for extreme heat is the one that's grounded by community perspective," the team shared.

Another project, led by Ph.D. student Miranda Elizarraras Botello and postbaccalaureate Salwa Sidahmed, focuses on reconnecting Indigenous communities with the UC Irvine San Joaquin Marsh Reserve. The team is compiling oral histories from Acjachemen, Gabrieleño, Kizh and Tongva peoples to create a digital book that honors ancestral ties to the land. Students worked alongside groups like GREEN-MPNA, Sacred Places Institute for Indigenous Peoples and Orange County Environmental Justice. Though CJI's NSF funding was temporarily halted, a court order restored it, ensuring current fellows can complete their work even as the program pauses enrollment for 2025–2026. ●

Chemistry Ph.D. Student Advocates for Nuclear Policy in Washington, D.C.

Audrey Miles, a second-year chemistry Ph.D. student at UC Irvine, recently participated in the Nuclear Engineering Student Delegation (NESD) in Washington, D.C., where she helped shape national conversations around nuclear energy and science-backed legislation. Miles, who conducts research in nuclear materials chemistry using machine learning to simulate advanced nuclear fuels, joined fellow students in meetings with top policymakers, including officials from the White House Office of Science and Technology Policy, the Department of Energy and the Nuclear Regulatory Commission.

"It was surreal to be asked, 'what did we miss in the executive orders?'" Miles said, reflecting on a pivotal moment during the delegation's White House visit. "We engaged in genuine conversation with the policymakers who have the power to enact real change." The delegation's policy statement emphasized federal research funding, workforce development and streamlining regulatory processes for nuclear technologies. Miles noted that her scientific background allowed her to "offer technical knowledge to contextualize why those laws would be beneficial or detrimental to the industry."

She also highlighted the importance of actionable advocacy. "Views mean little to policymakers unless they are substantiated by concrete actions," she said. "It was much more effective to focus on legislation already introduced rather than making abstract recommendations." Miles will return to Washington next year as NESD's vice chair, continuing her commitment to bridging science and policy. "Individuals with scientific backgrounds are crucial to the success of the 'policy machine' at all levels," she said. ●

Audrey Miles

Ph.D. student Audrey Miles stands in front of the U.S. Capitol in Washington, D.C. Miles was part of the Nuclear Engineering Student Delegation and travelled to the nation's capital to advocate for science-backed legislation.

2025 NSF Graduate Research Fellows

Eight students from the UC Irvine School of Physical Sciences received the prestigious 2025 National Science Foundation Graduate Research Fellowship (NSF GRFP) award. The fellowship is a five-year program that provides full financial support for three years, and it recognizes outstanding students pursuing research in STEM graduate programs.

> ***"Not only do they pursue research in innovative and impactful fields, but they also perform a broad range of mentorship and training efforts aimed at lifting up those around them. When the nation funds these students, they are investing in the hundreds of other people that these students engage with as well."***
>
> – **Franklin Dollar**, Associate Dean of Graduate Studies and professor in the UC Irvine Department of Physics & Astronomy

2025 **UC Irvine NSF GRFP** Recipients

Massee Akbar – Physics & Astronomy

Massee Akbar graduated with his bachelor's in physics from the UC Irvine Department of Physics & Astronomy this June and is beginning a Ph.D. this fall in the lab of Professor Howard Lee. With NSF support, Akbar is developing next-generation nanophotonic optical fibers—microscopes as thin as a human hair—by 3D-printing patterns onto fiber tips to control light without bulky lenses. The technology could one day make minimally invasive medical imaging possible.

Emma Brass – Chemistry

As a doctoral student with Professor Matthew Sheldon, Emma Brass researches the optical and thermal properties of perovskite quantum dots—tiny crystals at the forefront of solar cell technology. Her project focuses on using light to keep these nanocrystals cool, paving the way for more efficient solar energy devices.

Jay Krishnan – Physics & Astronomy

Jay Krishnan received his bachelor's in physics from the UC Irvine Department of Physics & Astronomy in 2022. Now a doctoral student with Professor Kevork Abazajian, his NSF-funded research explores massive galaxies that emerged just a few hundred million years after the Big Bang, investigating whether current cosmological models can account for their existence, or if new physics is needed to explain the formation of such large structures so early in the universe.

Makayla Luevano – Chemistry

Recent UC Irvine graduate and current Chemistry Ph.D. student at Georgia Tech, Makayla Luevano is building on work with Professor William Evans investigating the molecular properties of lanthanide and actinide elements, which are crucial to quantum information science and medical imaging. Her research aims to expand the known oxidation states and reactivity of rare earth elements, with implications for both synthesis and periodic trends.

Chad Moorman – Chemistry

As a doctoral candidate in the Matthew Griffin lab, Chad Moorman studies the human microbiome at the molecular level, focusing on how probiotics affect gut health. His NSF-supported work investigates the biochemical impact of probiotics in the context of the trillions of microbes essential to bodily function.

Berenice Rojas – Chemistry

A doctoral student in Professor James Smith's group, Berenice Rojas researches atmospheric chemistry with a focus on non-tailpipe vehicle emissions, such as brake wear particulates. Her field and lab work aim to identify chemical markers of pollution that impact human health, particularly in underserved communities. As an ACS Bridge Fellow, Rojas also emphasizes the importance of mentorship, inclusion and community in advancing environmental justice through science.

Silas Scribner – Chemistry

Silas Scribner is a doctoral student in the lab of Professor Vy Dong in the UC Irvine Department of Chemistry. He studies the use of rare earth metals such as yttrium as powerful catalysts in the synthesis of pharmaceuticals. His research addresses the challenge of creating molecules with specific structures, which is critical for developing safer, more effective drugs.

Tré Willingham – Physics & Astronomy

Tré Willingham, a doctoral student and Cal-Bridge scholar, researches quantum materials with Professor Javier Sanchez-Yamagishi. He develops high-temperature techniques to manipulate and study semiconductors at the nanoscale, deepening understanding of electronic phenomena. "The NSF GRFP is truly a monumental achievement for me… it gives me the freedom to conduct bold, high-impact quantum materials research," says Willingham. "I hope it shows what's possible and encourages more young Black men to imagine themselves as future scientists."

Innovation in Action

The Rise of Biotech Beauty

Joshua Britton was spending his days thinking about enzymes and his nights working as an Uber driver to make a little extra cash. He had recently returned to UC Irvine, where he had been a visiting Ph.D. student from Australia, to work with his former advisor, Gregory A. Weiss, professor in the departments of Chemistry, Molecular Biology and Biochemistry, and Pharmaceutical Sciences.

By day, they were working to rethink how complex ingredients could be manufactured. By night, Britton was turning his rideshare gig into pitch practice for the startup they hoped to build. So, he pitched. And pitched. And pitched. Until one evening, driving a passenger from John Wayne Airport to Newport Beach, his story landed. The passenger pulled out her checkbook and wrote a six-figure check on the condition that she would do some due diligence on Britton and Weiss before he cashed it. That first investment got the company off the ground.

Debut, once an idea pitched from the front seat, is now driving the conversation. With Britton as founder and CEO, Debut has raised tens of millions in venture capital, signed strategic partnerships with L'Oréal and earned a coveted spot on the TIME100 Most Influential Companies list. ●

Read the full story

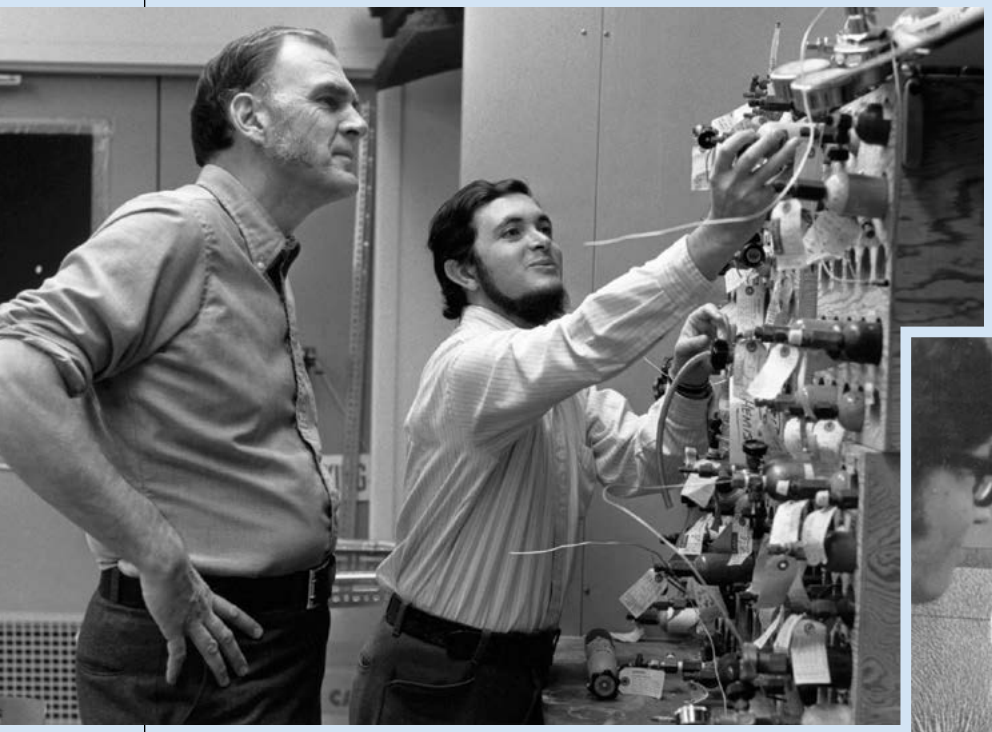
Reines and Rowland at 30: A Tale of Two Nobels

October 1995 marked a historic moment for UC Irvine.

In a single year, two founding faculty members – Frederick Reines and F. Sherwood "Sherry" Rowland – received Nobel Prizes for discoveries that fundamentally changed our understanding of the universe and our planet. Their groundbreaking work in particle physics and atmospheric chemistry didn't just earn them the highest honor in science, it established UC Irvine as a powerhouse of scientific discovery and showed how curiosity-driven research can literally save the world.

At UC Irvine, Professor Rowland and postdoctoral scholar Mario Molina discovered that human-made chemicals were destroying Earth's protective ozone layer. Their findings led to the Montreal Protocol, preventing a global environmental crisis that would have exposed all life on Earth to dangerous levels of ultraviolet radiation.

Professor Frederick Reines co-discovered one of the most elusive particles in the universe: the neutrino. From his work on the Manhattan Project to becoming founding dean of UC Irvine's School of Physical Sciences, Reines dedicated his career to solving the universe's most challenging puzzles.



> ***"The only trouble is [that] I think it's the end of the world."***
>
> — **Sherry Rowland** to his wife, Joan, after grasping the implications of the discovery

> ***"Everyone said it would be impossible to detect a neutrino, and that was exactly why Reines wanted to try."***
>
> — **Henry "Hank" Sobel**, Professor Emeritus of Physics and Astronomy, UC Irvine

Read more about their legacy 30 years later

Research

Research Funding

Funding Source	FY 2025 Amount
Federal	$46,996,937
Other Government	$248,274
State	$545,412
UC	$401,032
Non-Profit	$1,315,635
Profit-Making	$910,630
Total	**$50,417,921**

Where Our Research Happens

415,072 total square feet

Classroom Labs – 24,719 square feet

Research Labs – 210,657 square feet

Solutions For A Sustainable Future

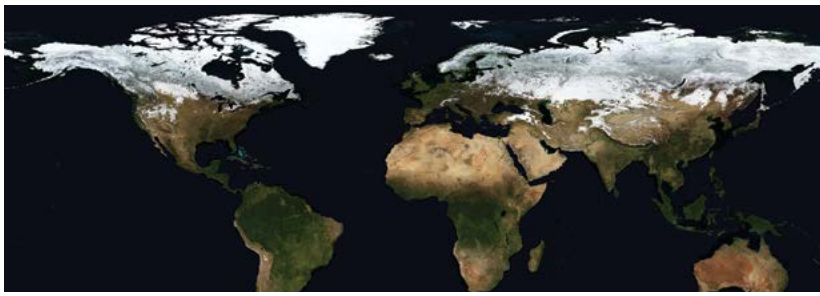
Scientists at UC Irvine are redefining what's possible in climate research and action. From recalibrating the world's carbon budget to equipping communities with tools to survive deadly heatwaves, our researchers are leading the charge to safeguard our future—right here in California and around the globe.

Scientists Reveal Land Absorbs Less CO_2 Than Previously Thought

Where does all the carbon go? For years, scientists estimated that land plants and soils soak up about 1.6 petagrams of carbon dioxide (CO_2) from the atmosphere annually. But groundbreaking research from UC Irvine is changing the global carbon story.

In a landmark study published in *Science Advances*, James Randerson, Ralph J. and Carol M. Cicerone Professor in the Department of Earth System Science, and his team used cutting-edge satellite data and machine learning to measure how much carbon the world's land ecosystems absorb. Their surprising finding: the global land sink is only half as large as previous estimates.

The results show land isn't taking up as much carbon as previously thought.



NASA

This new math means other parts of the carbon cycle, like oceans and fossil fuel emissions, also need to be updated. The team's work suggests oceans absorb 8% more carbon than earlier reports, and global fossil fuel emissions may be 6% lower than expected.

Why does it matter? Accurate carbon budgets drive climate policy, carbon markets and the way the world fights global warming. UC Irvine's breakthrough brings a fresh perspective to a question that shapes the future of the planet.

> ***"Advances in remote sensing and AI let us track plant biomass with far greater precision," says Randerson. "Our results show land isn't taking up as much carbon as we thought."***
>
> **— Professor James Randerson**

Delivering Life-saving Heatwave Science

On a record-hot day, finding relief from a heatwave is more urgent than ever—especially as climate change drives longer, deadlier extremes worldwide.

At UC Irvine, Assistant Professor of Earth System Science Jane Baldwin is translating advanced climate data into real-world protection for communities at greatest risk.

Her research is answering that call—and saving lives.

Understanding the Human Factor

Deadly heatwaves are getting worse, but not everyone faces the same risks. Baldwin's work captures the full picture: age, health, physical activity, local behaviors and even social factors like access to shade or cooling centers. Her collaborations span physiologists, scientists and grassroots organizations both abroad and right here in Orange County.

Global Impact, Local Action

On the home front, Baldwin's graduate student Haley Staudmyer partners with Santa Ana advocates to understand—and improve—the ways communities beat the heat, from public libraries to home air conditioning. "There's no single solution," says Staudmyer. "We have to build trust and listen to what people need."

Why This Research Matters

Heatwaves already kill more people than hurricanes, floods and other natural disasters combined. UC Irvine's science is empowering cities to craft life-saving solutions, informed by both cutting-edge climate models and on-the-ground realities. ●

UC Irvine

Transforming Health

At UC Irvine, science is the engine behind tomorrow's medicines. From next-gen antibiotics to the power of artificial intelligence in cancer care, our researchers are delivering breakthroughs to improve and save lives.

Inventing the Next Generation of Antibiotics

UC Irvine

Ph.D. candidate Sophia Padilla and Professor James Nowick of the UC Irvine Department of Chemistry are helping redefine how doctors treat lethal bacterial infections.

There's an urgent arms race in medicine. Scientists design drugs to treat lethal bacterial infections, but bacteria evolve defenses against antibiotics, sending doctors back to square one. UC Irvine chemists have developed a drug candidate that can stop bacteria before they have a chance to cause harm — offering hope for the millions affected by antibiotic-resistant infections each year.

"When it comes to antibiotics, bacteria are becoming stronger and always getting better at protecting themselves," said Sophia Padilla, a Ph.D. candidate in chemistry and lead author of the new study in Journal of the American Chemical Society.

About 35,000 people in the U.S. die annually from drug-resistant bacteria, and 2.8 million become ill.

This new drug candidate, based on a reengineered version of vancomycin, "grabs" bacteria with both hands, targeting two sites at once — a process Professor James Nowick likens to subduing pathogens in a molecular double-grip.

With this approach, the UC Irvine team aims to outmaneuver bacterial evolution, potentially bringing an end to the costly "arms race" of drug development.

"In terms of antibiotic development, I believe we shouldn't focus solely on modifying what we already know works but rather take a step back and adopt a new approach," said Padilla.

AI Takes on Brain Cancer: Data, Math, and Hope for Patients

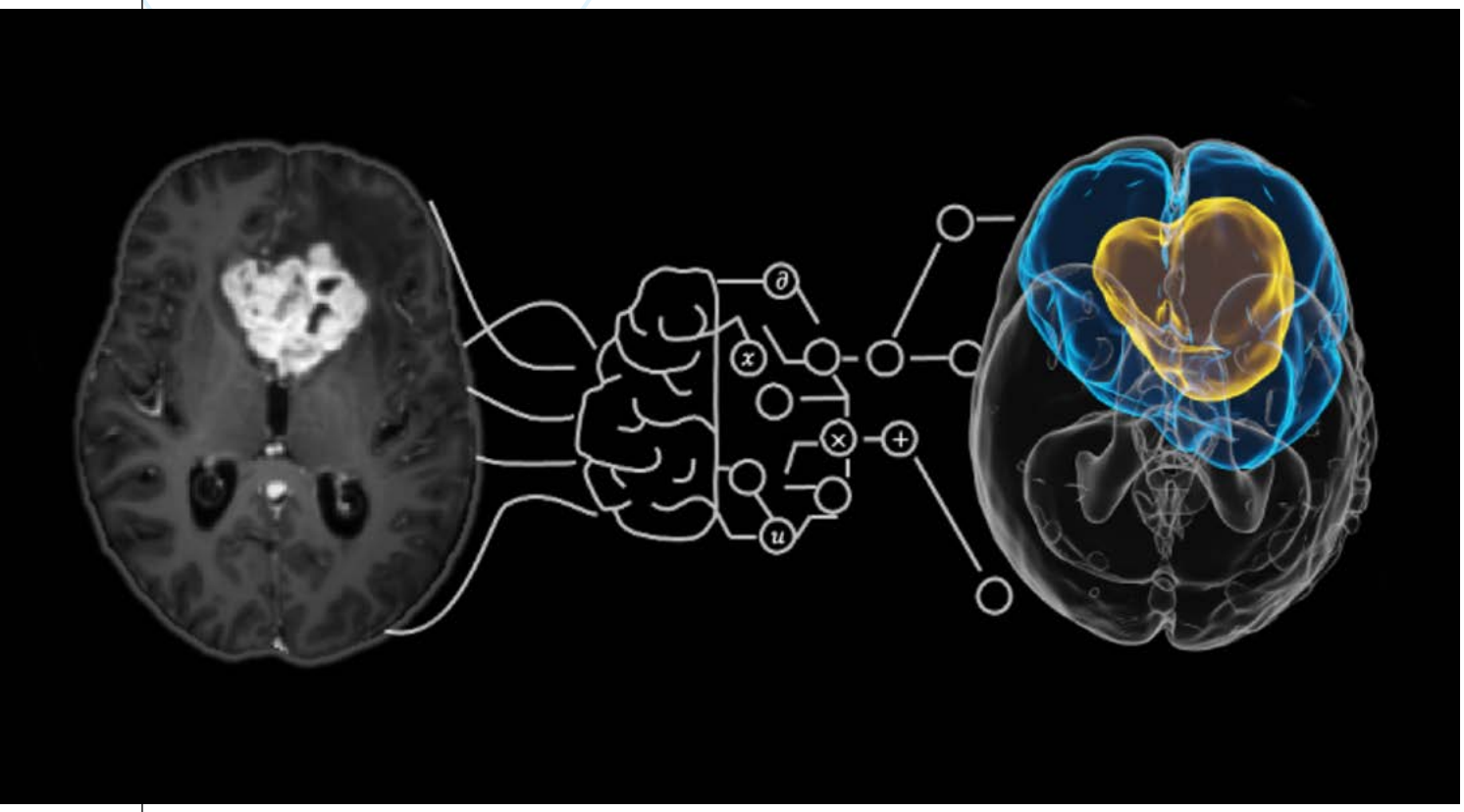
Glioblastoma is a common and aggressive form of brain tumor — tough to spot, trickier to treat. Researchers at UC Irvine are at the forefront of using AI and advanced math to help doctors see beyond standard scans and improve patient treatments.

The team, led by visiting assistant professor Ray Zhang, is pushing beyond current treatment approaches, focusing on patient-specific mathematical modeling.

"AI's power lies in its ability to identify patterns from massive amounts of data – far beyond what humans could process manually – and integrate data of very different types such as genomics, image scans and family history," said Zhang.

He works closely with Professor John Lowengrub, whose work blends mathematics, computation and biomedical engineering. "To predict how far tumor cells have infiltrated surrounding brain tissue, we use machine learning algorithms that combine mathematical models of tumor growth with data from standard-of-care medical images," says Lowengrub. "This is a novel approach for accurately estimating patient-specific predictions that may improve radiotherapy planning. Knowing the extent of infiltration and the density of tumor cells, we can target cancer cells more precisely while sparing healthy tissue."

Despite the challenges—such as obtaining enough high-quality data—the approach could revolutionize not just diagnosis but also aid in developing therapies tailored for each person fighting this devastating disease. ●



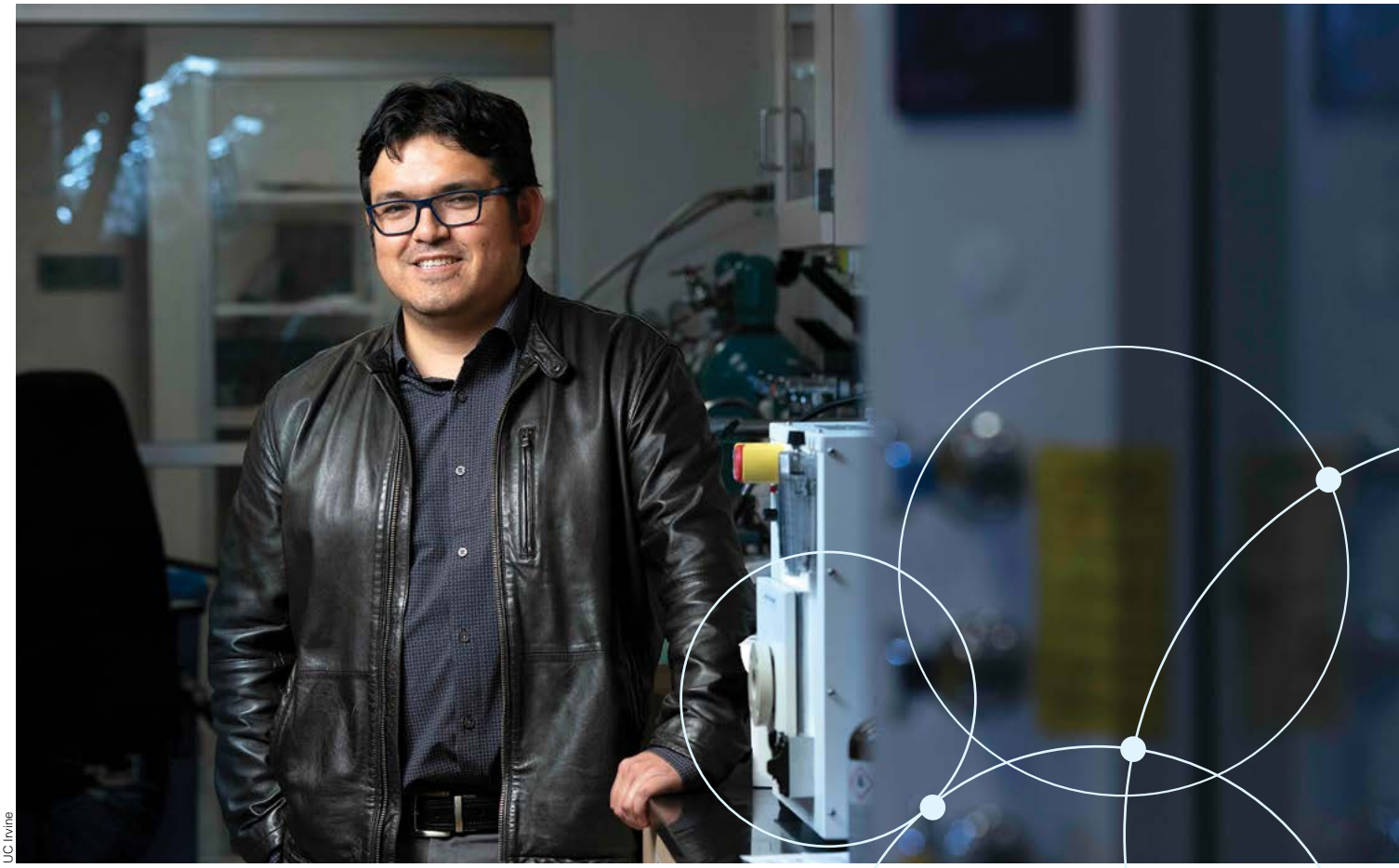
Ray Zhang, John S. Lowengrub / UC Irvine

On the left, a brain MRI scan that showcases the tumor region. On the right, a 3D visualization that predicts tumor growth regions (yellow/blue).

The Quantum Frontier

From new states of matter to transformative investment in education and research, UC Irvine is powering the next wave of quantum breakthroughs.

Discovering A New State of Quantum Matter



UC Irvine

Professor Luis Jauregui of the UC Irvine Department of Physics & Astronomy.

Researchers in the lab of Department of Physics & Astronomy Professor Luis Jauregui, have discovered a new state of quantum matter—one that exists nowhere else in the world except at UC Irvine.

This material, forged and measured at UC Irvine, only emerges under ultra-strong magnetic fields and offers extraordinary promise for deep-space technology. Its unique properties may one day enable the development of computers that don't need to be charged and which are immune to the damaging effects of cosmic radiation. "It's a new phase of matter, similar to how water can exist as liquid, ice or vapor," says Jauregui.

This quantum state is built from "excitons"—electron-hole pairs spinning in sync—and, if visible to the naked eye, would glow with brilliant light. Crucially, it may provide a pathway for signals to be carried by spin, not just charge, ushering in a new era of energy-efficient, spin-based electronics.

Unlike typical electronics materials, this quantum matter is unaffected by radiation, making it an ideal candidate for computers aboard future Mars-bound missions.

Space and Future Technologies

UC Irvine scientists are answering the universe's biggest questions—how matter works, where life might be found and how new technologies can change what's possible.

JUNO: The Heart of a Landmark Physics Experiment

UC Irvine physicists helped launch the JUNO detector in China, now taking its first data after a decade of global teamwork. Located deep underground, JUNO's technology will help solve one of the greatest mysteries in particle physics: the ordering of neutrino masses. UC Irvine is the only U.S. university with full membership in the JUNO collaboration, continuing a legacy that traces back to UC Irvine founding faculty member Frederick Reines' Nobel Prize-winning neutrino discovery.

JUNO will allow scientists to analyze neutrinos – tiny, nearly invisible particles known as "ghost particles" because they pass through people and even whole planets without leaving a trace. The research will shed light on everything, from what happens inside exploding stars to what's deep within our planet.

- **State-of-the-art detector in Guangdong Province, China**
- **International scientific collaboration and leadership**
- **Training opportunities and hands-on work for UC Irvine students, postdocs and faculty**

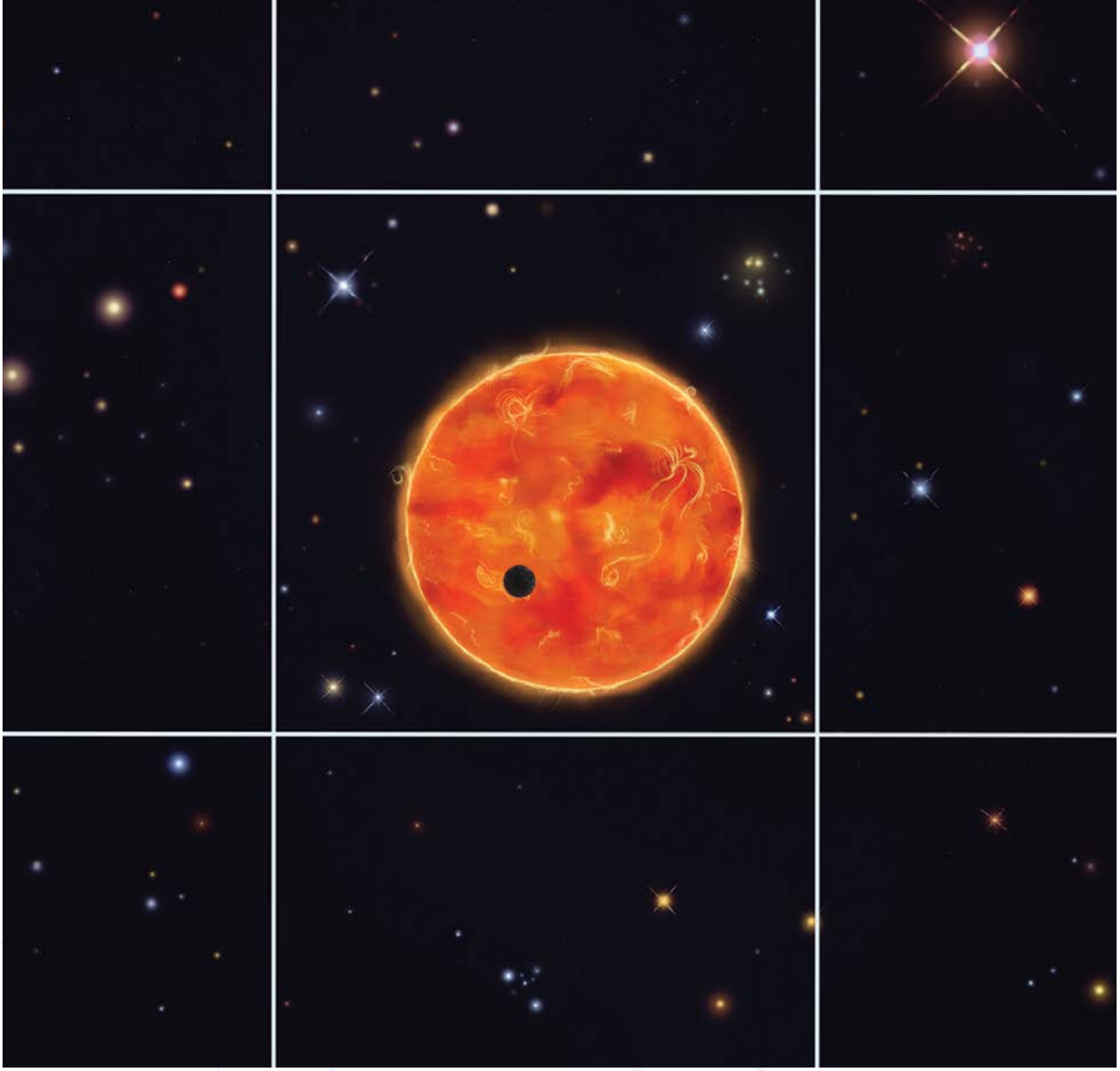
Read the full story

J. Pedro Ochoa-Ricoux, professor of physics and astronomy at UC Irvine, standing in front of the detector during construction.

“This is an incredibly exciting time for us. After working on the design and construction of this project for over a decade, the time has finally come when we can turn on this cutting-edge scientific instrument.”

— **J. Pedro Ochoa-Ricoux**, Professor of Physics & Astronomy

JUNO’s golden photomultiplier tubes line the inside of the detector. These extremely sensitive semispheres detect the light produced by neutrino interactions.



Nikolai Berman / UC Irvine

An exoplanet host with several background stars. If left uncorrected, the additional light from the background stars can lead to underestimated exoplanet size measurements. The square grid represents individual pixels from NASA's TESS satellite.

Rethinking the Hunt for Life Beyond Earth

A team led by doctoral student Te Han and Professor Paul Robertson discovered that more than 200 known exoplanets are significantly larger than thought. "We found that hundreds of exoplanets are larger than they appear, and that shifts our understanding of exoplanets on a large scale," said Han.

The culprit: light from nearby stars "contaminating" the view, causing the most promising planets to look deceptively small. This means that many "Earth-sized" planets discovered so far are larger water worlds, or even gas giants—shifting where researchers look for signs of extraterrestrial life.

The finding calls for a reevaluation of planets for NASA's James Webb Space Telescope and stirs debate about how best to search for alien environments. ●

Implications for the future:

- **Fewer "rocky" planets than we thought—redefining targets for habitability**
- **More "water worlds" and candidate planets for deep-dive atmospheric study**

Education and Outreach

UC Irvine Becomes Host Campus for Cal-Bridge Program

Cal-Bridge, a statewide initiative to diversify California's science and technology workforce, has entered its second decade with new administrative headquarters at UC Irvine. The program, which supports underrepresented students in physics, astronomy, computer science and math is now led from UC Irvine by co-founder and executive director Alexander Rudolph. "UC Irvine has been the most strongly engaged UC campus in Cal-Bridge," said Rudolph. "Its support has helped the program flourish across the UC and CSU systems." Cal-Bridge provides a comprehensive pathway to Ph.D. programs and STEM careers through financial aid, intensive mentorship, summer research and professional development. UC Irvine has accepted more Cal-Bridge scholars into Ph.D. programs than any other UC campus.

The program began in 2009 as CAMPARE, a summer research initiative, and officially launched as Cal-Bridge in 2014 with NSF funding. It has since grown to include fellowships, cohort-building and a postdoctoral program—creating what Rudolph calls an "end-to-end pathway" to the tech workforce or academia. Mentorship is central to Cal-Bridge's success. Scholars are "dual mentored" by CSU and UC faculty, meeting at least twice a month. This hands-on support, combined with a strong peer community and financial assistance, helps students focus on academics and thrive. With its new home at UC Irvine, Cal-Bridge is poised to expand its impact and strengthen the future of STEM in California. ●

Eddie Cisneros

The 2024 Cal-Bridge Fall Conference, which took place at the UC Irvine Student Center, was attended by hundreds of Cal-Bridge scholars and faculty members representing University of California, California State University, and California Community College institutions throughout the Golden State.

Empowering Math and Science Teachers for California's Classrooms

UC Irvine's CalTeach program gives science and math majors the opportunity to finish their degree while earning a California teaching credential—making it possible for undergraduates to become fully certified math and science educators in just four years.

For students like Nancy, the program is transformative: "When students are encouraged to explore and experiment, they begin to see science not as a list of facts to memorize, but as something alive, creative and full of possibility. That's the kind of classroom I want to build."

Unlike typical teacher training paths that require extra years of study, UCI CalTeach students gain classroom experience while completing their degrees. "We are doing our part to decrease both the time and cost of gaining a teaching credential," said Director Ellie Marsh.

Alumni like Kent Vi, now a high school chemistry and physics teacher, credit UCI CalTeach with providing the practical skills and mentorship that make a lasting difference in California classrooms. "CalTeach gave us time to prepare for realistic situations and effectively manage our classrooms," Vi says.

With dedicated student spaces, hands-on training, and a tight-knit community, UCI CalTeach is shaping the next generation of science and math teachers ready to inspire curiosity and excellence in every student.

Isaac Membreno

The 2025 UC Irvine CalTeach cohort gathers for a group photo to celebrate earning their degrees in the School of Physical Sciences in addition to a California teaching credential.

> ***"It gives me the courage, clarity and classroom experience I need to become the teacher I've always dreamed of being."***
>
> — **Nancy**, UCI CalTeach student

Transforming Math Education in Orange County

In 2014, Professors Alessandra Pantano and Li-Sheng Tseng established Math CEO (Community Education Outreach), a program that enables UC Irvine undergraduate students to mentor local middle and high school students from Santa Ana, fostering not only improved math skills but also belonging and confidence.

A recent study found that Math CEO participants improved in test scores, grades and school attendance. Former mentee Mercedes Barriga was so inspired by the program, that she later attended UC Irvine for college, majored in education, and returned to Math CEO as a mentor.

Supported by a National Science Foundation grant and ongoing research on culturally responsive mentoring, the program's approach is redefining how universities can build inclusive academic opportunities—from campus to community.

Pantano and Tseng continue to bolster a culture where UC Irvine students lead, mentor, and build bridges in local schools. The Math CEO program exemplifies how the School of Physical Sciences empowers students to drive change, discover joy in learning, and cultivate the next generation of STEM leaders.

> ***"Through Math CEO, I also found a community on campus where I was able to make friends and feel like I belonged...It felt good to be able to give back."***
>
> — **Mercedes Barriga**

Alice Vo/UC Irvine

2023-2024 Middle School and High School Participant Outcomes

449

Youth Participants
From fall 2023 to spring 2025

76%
reported positive math ability self-concept (i.e., how good they think they are math)

78%
reported a positive interest in math

92%
thought math was important

Learn More

Science Beyond Campus

UC Irvine Astronomy and Physics Students Spark Curiosity at Discovery Cube OC

In spring 2025, UC Irvine Physical Sciences undergraduates and graduates volunteered as "solar system specialists" at the Discovery Cube OC's Solar System Encounter exhibit. Students ran a fun solar system scavenger hunt for children and fielded questions about planets, stars and space exploration. ●

Community College Transfer Students Guide Future Scientists

UC Irvine graduate students who began their own college journeys as community college students served as panelists, mentors and science ambassadors during Compton College's 2025 STEM Week. Activities included a graduate panel about pursuing a STEM Ph.D., tabling at the Compton College Science Symposium with resources about transferring to UC Irvine and hosting an on-campus field trip for Compton College students to tour UC Irvine labs and meet faculty. ●

UC Irvine

Compton College students visiting the UC Irvine campus.

Creating **Opportunity** & **Advancing Science** with Leading U.S. National Laboratory

Brighter Together: UC Irvine and Los Alamos National Laboratory Advance Quantum Science Through Joint Appointments

A growing partnership between UC Irvine's School of Physical Sciences and Los Alamos National Laboratory is accelerating breakthroughs in quantum science. This year, two new joint appointments were established: Professor Luis Jauregui of UC Irvine's Department of Physics & Astronomy joined LANL, while LANL's Michael Pettes became a professional researcher at UC Irvine.

These appointments are already yielding results. Jauregui's group, which develops next-generation quantum materials, leveraged LANL's advanced instrumentation to co-develop hafnium pentalluride ($HfTe_5$)—a material with potential applications in radiation-resistant, charge-free devices. "The appointment provides access to facilities and perspectives we could not replicate at UC Irvine," said Jauregui.

Professor Luis Jauregui

Michael Pettes

The collaboration is also training future scientists. Graduate student Marshall Campbell, a recipient of the UCI-LANL-SoCal Hub and UC-National Lab In-Residence fellowships, works across both labs. His work with Pettes has led to multiple high-impact publications.

Pettes emphasized the value of UC Irvine's talent pipeline, noting that a former UC Irvine graduate student is now a postdoc at LANL's Center for Integrated Nanotechnologies. "This has accelerated my work," he said.

The UC system continues to invest in such partnerships, recently launching a multi-campus initiative to deepen ties with LANL, Lawrence Livermore and Lawrence Berkeley National Laboratories.

"I see my appointment as a bridge between UC Irvine and LANL," said Jauregui. "It's fostering strong collaborations and preparing the next generation of scientists to think across disciplines."

New cohort of UCI-LANL-SoCal Hub Fellows Advancing Their Fields at Top National Laboratory

The fellowship gives UC Irvine graduate students the opportunity to work directly with leading scientists at Los Alamos National Laboratory. Since the program was established three years ago, nine students in the School of Physical Sciences have participated, immersing themselves in high-impact research projects alongside their UC Irvine faculty advisors and LANL mentors. Each fellow receives one year of funding to support their research with LANL.

Each fellow's research and collaboration with LANL highlight the opportunities fostered by the program. Below are some pioneering research endeavors that have resulted from the partnership between UC Irvine and Los Alamos National Laboratory.

2025-2026 **UCI-LANL-SoCal Hub** graduate fellows

Julian Arnheim, Earth System Science
UC Irvine Advisor: Gudrun Magnusdottir
LANL Mentor: Wilbert Weijer

Julian Arnheim, a Ph.D. student in Professor Gudrun Magnusdottir's lab at UC Irvine, uses models to study the polar jet stream—fast, narrow winds 10 to 15 kilometers above Earth that steer mid-latitude weather. "With this fellowship, I'm applying established methods to assess the strength and behavior of the jet stream to the U.S. Department of Energy's Energy Exascale Earth System Model," said Arnheim. He's especially focused on the North Atlantic, "a region where many climate models project a patch of cooling off the southern coast of Greenland even as nearly all the world's oceans warm."

Izzie Catanzaro, Physics & Astronomy
UC Irvine Advisor: Luis Jauregui
LANL Mentor: Priscila Rosa

Izzie Catanzaro, a Ph.D. student in Professor Luis Jauregui's lab at UC Irvine, studies how acoustic waves travel via electric currents in graphene, a two-dimensional quantum material that can act as a superconductor. "I was awarded the So-Cal LANL fellowship to work with Dr. Priscila Rosa doing electronic transport of a 2-D unconventional superconductor called uranium teleride," said Catanzaro. "The 3-D crystal form of this compound exhibits superconductivity that's dependent on the pressure of the surrounding system," which allows researchers to study it using acoustic waves.

Jayme Chow, Chemistry
UC Irvine Advisor: Stacy Copp
LANL Mentor: John Watt

Jayme Chow, a Ph.D. candidate in Professor Stacy Copp's lab at UC Irvine, studies the material properties of gold nanoparticles. "With the fellowship, working with Dr. John Watt at CINT, I'm going to be able to characterize and analyze my samples with state-of-the-art equipment at LANL," said Chow. The fellowship supports her work to improve how nanomaterials are made. "Our method is much more generalizable and universal to different nanoparticle types," she said. "With a more universal approach, this could open the gate to accessing novel materials with unique optical properties" for a wide range of applications.

Cesar Gallegos, Physics & Astronomy
UC Irvine Advisor: Alexander (Sasha) Chernyshev
LANL Mentor: Shi-Zeng Lin

UC Irvine Ph.D. student Cesar Gallegos is researching quantum materials that could revolutionize technology by enabling devices to hold a charge without electricity. "Modern electronic devices face a fundamental limitation, as the flow of charge inevitably generates heat," said Gallegos, a first-generation Ph.D. student. "To overcome this challenge, we can turn to another quantum-mechanical property of electrons: their magnetic moment, or spin." By focusing on spin instead of charge, Gallegos aims to develop "quantum magnets," materials whose collective excitations "can transport energy with minimal dissipation," potentially eliminating energy loss in future electronic devices.

Faculty Highlights

New Faculty

Mark England, Department of Earth System Science

Uses climate models to simulate and understand the driving forces and impacts behind our changing climate, with a special focus on Earth's polar regions.

Andre Frankenthal, Department of Physics & Astronomy

Studies how elusive dark matter might be formed by investigating its potential particle nature through large-scale experiments at international physics laboratories.

Lyssa Freese, Department of Earth System Science

Combines climate science, atmospheric chemistry and social systems research, with a special focus on analyzing the impacts of and solutions to climate change and air pollution.

Leonard Ohenhen, Department of Earth System Science

Investigates how alteration and deformation of the surface of the planet by natural processes and human activities changes the environmental risks posed by those changed regions.

Rex Handford, Department of Chemistry

Studies the chemistry involved in converting typically inert chemicals into potent fuels as part of a low-carbon energy economy. Handford's new lab will work to understand the molecules that spark the conversion of those inert chemicals into sustainable fuels

Dr. Barbara Finlayson-Pitts Wins 2025 L'Oréal-UNESCO For Women in Science Award

Barbara Finlayson-Pitts, Distinguished Professor Emerita and Founder and Co-Director of AirUCI, has been named a 2025 L'Oréal-UNESCO For Women in Science Laureate. This prestigious international award recognizes her pioneering contributions to environmental science and atmospheric chemistry. Established in 1998, the L'Oréal-UNESCO For Women in Science program annually honors five exceptional female scientists, one from each of five global regions: Africa and the Arab States, Asia and the Pacific, Europe, Latin America and the Caribbean, and North America. Professor Finlayson-Pitts represents North America in this year's cohort of laureates.

The award celebrates Finlayson-Pitts' transformative research in atmospheric chemistry, which has significantly advanced our understanding of air quality and climate change. Her experimental studies on complex atmospheric chemical reactions have provided crucial insights into pollutant formation and transformation, informing environmental policies worldwide. As Co-Director of UC Irvine's Atmospheric Integrated Research Institute (AirUCI), Finlayson-Pitts has been at the forefront of addressing critical global health issues related to air pollution. Her work on the interactions between nitrogen oxides and sea salt has revealed key mechanisms in smog formation, contributing to the development of effective pollution control strategies.

A trailblazer in her field, Finlayson-Pitts has inspired generations of scientists and advocates for rigorous, collaborative and innovative research. Her academic journey serves as inspiration for women and underrepresented groups in STEM, demonstrating her commitment to fostering an inclusive and equitable scientific community. ●

Photos: L'Oréal-UNESCO

Howard Lee selected as Moore Experimental Physics Investigator to Develop Revolutionary Nanoscale Electron Accelerator

Professor Howard Lee in the UC Irvine Department of Physics & Astronomy has been named a 2025 Experimental Physics Investigator by the Gordon and Betty Moore Foundation. The funding will support Lee in advancing groundbreaking research in nanoscale electron acceleration technology. Lee is developing the world's first nanoscale electron accelerator by merging advanced nano-optical materials and nanostructures with laser wakefield acceleration. Unlike traditional accelerators such as the Large Hadron Collider that require extensive long well-defined channels, Lee's apparatus uses nanoscale solid-state materials and high-power ultrafast lasers to accelerate electrons and generate X-rays.

"This award is significant since it allows me to pursue an entirely new research direction not previously explored," Lee said. "Given the current funding climate, the opportunity to support research with bold new ideas is truly game-changing for my group, allowing us to further advance optical science and technology. I am deeply grateful to the Moore Foundation for their generous support." Lee's work could enable new medical therapies, including laser wakefield accelerator optical fiber endoscope probes and free electron laser devices for next-generation biomedical and imaging technologies. When integrated into optical fibers, these nanoscale accelerators could open transformative biomedical applications, including advanced cancer treatments.

UC Irvine/Tatiana Overly

Faculty Awards and Honors

UC Irvine Awards

Henri Drake
Assistant Professor of Earth System Science
2025 Hellman Fellow

William Evans
Distinguished Professor Emeritus of Chemistry
Academic Senate Award for Daniel G. Aldrich, Jr. Distinguished University Service Award

Sarah Finkeldei
Associate Professor of Chemistry
UC Irvine Division of Teaching Excellence and Innovation 2024 Deans' Honoree

Barbara Finlayson-Pitts
Distinguished Professor Emeritus of Chemistry
Academic Senate Award – Better World Award

Elizabeth Jarvo
Professor of Chemistry
Academic Senate Award for Distinguished Faculty Award for Mentorship

Renee Link
Professor of Teaching of Chemistry
UC Irvine Division of Teaching Excellence and Innovation Excellence in Digital Learning Award

Christopher Miles
Associate Professor of Mathematics
Distinguished Early-Career Faculty Award for Teaching

Sergey Nizkorodov
Professor of Chemistry
2025 Chancellor's Award for Distinguished Fostering of Undergraduate Research, Chancellor's Professor

Alessandra Pantano
Professor of Teaching of Mathematics
Distinguished Faculty Award for Teaching

Zuzanna Siwy
Professor of Physics & Astronomy
Professor (Joint Appt) of Chemistry
UC Irvine Applause Award

Toshiki Tajima
Adjunct Professor of Physics & Astronomy
UC Irvine Lauds & Laurels Outstanding Faculty Achievement Award

Fellowships

Kev Abazajian
Professor of Physics & Astronomy
American Association for the Advancement of Science (AAAS)

Aaron Barth
Professor of Physics & Astronomy
American Association for the Advancement of Science (AAAS)

Howard Lee
Professor of Physics & Astronomy
Optica Fellowship

Adam Martiny
Professor of Earth System Science
Professor (Joint Appt) of Ecology & Evolutionary Biology
American Academy of Microbiology
American Geophysical Union (AGU)

Eric Rignot
Professor of Earth System Science
National Academy of Engineering

Jack Xin
Professor of Mathematics
Member of National Academy of Artificial Intelligence

External Awards

Maxx Arguilla
Assistant Professor of Chemistry
National Fresenius Award, Rose Hills Foundation Innovator Grant

Franklin Dollar
Professor of Physics & Astronomy
AISES Professional of the Year Award, NSF Presidential Early Career Award for Scientists and Engineers

Celia Faiola
Associate Professor of Ecology & Evolutionary Biology
Associate Professor (Joint Appt) of Chemistry
2025 Kenneth T. Whitby Award sponsored by AAAR

Jonathan Feng
Professor of Physics & Astronomy
Frontiers of Science Award

Sarah Finkeldei
Associate Professor of Chemistry
American Nuclear Society's list of 40 under 40

Barbara Finlayson-Pitts
Distinguished Professor Emeritus of Chemistry
2025 L'Oreal-UNESCO for Women in Science Award

William Heidbrink
Distinguished Professor Emeritus of Physics & Astronomy
Maxwell Prize for Plasma Physics

Howard Lee
Professor of Physics & Astronomy
IEEE Photonics Society Distinguished Lectureship, Moore Foundation Experimental Physics Investigator Award

Adam Martiny
Professor of Earth System Science
Professor (Joint Appt) of Ecology & Evolutionary Biology
National Oceanographic Program Partnership Award

James Nowick
Distinguished Professor of Chemistry
Bipolymers Murray Goodman Memorial Prize

Alessandra Pantano
Professor of Teaching of Mathematics
2025 AMS Award for Exemplary Achievement in Mathematics Education (MathCEO)

Kenneth Shea
Distinguished Professor Emeritus of Chemistry
Tolman Award

Aomawa Shields
Associate Professor of Physics & Astronomy
NSF Presidential Early Career Award for Scientists and Engineers

Li-Sheng Tseng
Professor of Mathematics
2025 AMS Award for Exemplary Achievement in Mathematics Education (MathCEO)

Charlie Zender
Professor of Earth System Science
Professor (Joint Appt) of Computer Science
AGU Open Science Recognition Prize

Breakthrough Prize in Fundamental Physics

David Casper
Associate Professor of Physics & Astronomy

Andrew Lankford
Distinguished Professor Emeritus of Physics & Astronomy

Juan Pedro Ochoa-Ricoux
Professor of Physics & Astronomy

Anyes Taffard
Professor of Physics & Astronomy

Daniel Whiteson
Professor of Physics & Astronomy

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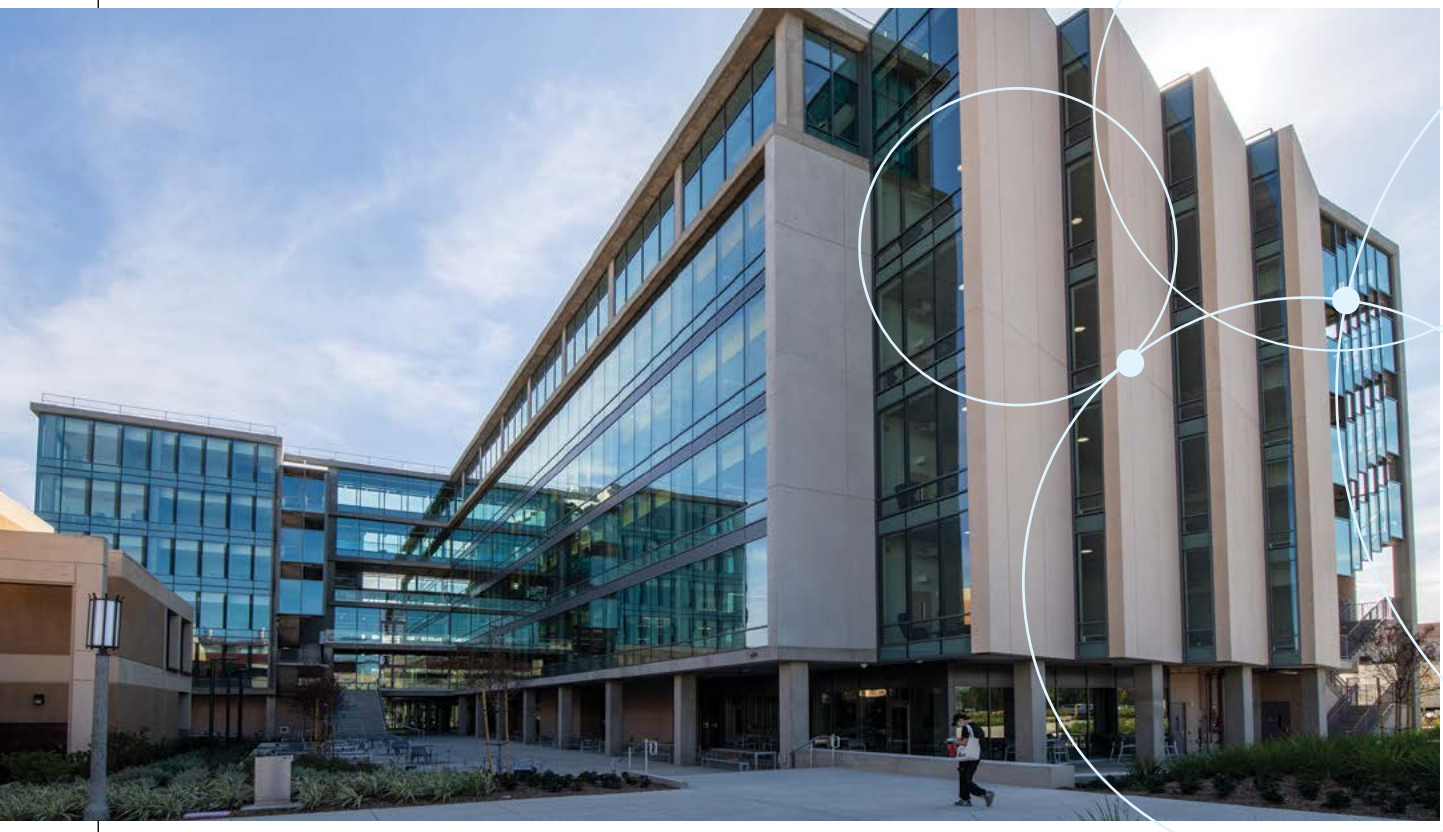

Philanthropy

Be a Part of Our Impact

These are challenging times for science and math. But at the UC Irvine School of Physical Sciences, we boldly imagine a better future built on breakthrough science, transformative education and partnerships that drive real change. As we look forward to the year ahead, we invite you to join us on this journey.

Support from our community fuels:

- Scholarships and fellowships
- World-class faculty recruitment
- Breakthrough research and state-of-the-art facilities
- STEM outreach around Orange County

Every gift, internship and partnership helps us shape the future. Right here, right now.

To make a gift, contact:
Sharon Chang, Executive Director of Development
sharon.chang@uci.edu

To partner with us, contact:
Tatiana Overly, Director of Communications & External Relations
toverly@uci.edu

UCI Eddleman Quantum Institute

Matching Gift Opportunity

Roy T. Eddleman was a pioneer in science, and a philanthropist who had a lifelong passion for helping others. Roy dedicated his life to discovery, and believed that "quantum science holds significant promises for humanity."

Now, the UC Irvine School of Physical Sciences is pleased to present Eddleman Quantum Institute Matching Gift Funds, a 2x and 3x matching gift opportunity:

2x Eddleman Quantum Institute Match
($50,000 minimum)
Named endowment in support of general quantum science

Distributions will be matched 1:1 for five years after the endowment has been fulfilled.

3x Eddleman Quantum Institute and The Hellman Fellows Match
($250,00 minimum)
Named endowment to "lift-off" the careers of assistant professors in quantum science

Distributions will be matched 2:1 for five years after the endowment has been fulfilled.

Pledges are payable over a maximum of five years. Only cash gifts and pledges will be matched. Deferred planned gifts are not eligible for the match.

Eddleman Quantum Institute Matching Gift Funds are limited and available on a first-come, first-served basis. Matching funds will not be included in donor recognition gift amounts.

To learn more about the Eddleman Quantum Institute and its Matching Gift Funds, please contact:

Sharon Chang, Executive Director of Development
sharon.chang@uci.edu
657-640-7031

UCI Eddleman Quantum Institute

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JUNO's golden photomultiplier tubes line the inside of the detector. These extremely sensitive semispheres detect the light produced by neutrino interactions.
Read more on page 18.

Photo: Yuexiang Liu / Institute of High Energy Physics